

its steaming shores with their countless hot springs, boiling geysers, steaming cauldrons, and seething mud-pools, as well as by the bold, rugged scenery which surrounded it on every side. The name Rotomahana in the native language means literally "hot lake." The mean temperature of the water was about 80° F., while in the vicinity of the hot springs it rose frequently to 212° F.

It was on either shore of this lake that the marvellous terraces now unfortunately reported to be destroyed were situated. The largest of these singular formations was Te Tarata, or the White Terrace, the outline of which assumed a semicircular form and spread out at its base as it sloped gently down to the margin of the lake; the broad, flat, rounded steps of pure white silica rose tier above tier white and smooth as Parian marble and above them terrace after terrace mounted upwards, rounded and semicircular in form. All were formed out of a delicate tracery of silica, which appeared like lacework congealed into alabaster of the purest hue; crystal pools shaped as if to resemble the form of shells and leaves, and filled to their brims with water blue and shining as liquid turquoise charmed the eye, while around the edges bright crystals of silica formed incrustations which made them appear as if set with a margin of miniature pearls. At the summit of the terrace was a crater of 200 feet in diameter filled to overflowing with brilliant transparent water in the form of a boiling fountain, from which clouds of steam floated constantly upward. This boiling spring formed an intermittent geyser, which during its active intervals threw up a column of water to a height of over 100 feet. The crater, however, was always overflowing, and the water, which was highly charged with silica, had by a gradual process of deposition, extending probably over a vast period, formed the present system of terraces. The temperature of the water varied from boiling point to 70° F. at the foot of the terrace, the summit of which was over 80 feet above the level of the lake.

Immediately at the back of the White Terrace and bordering the lake was a rocky desolate gorge seamed and furrowed in every direction with streams of hot water, while jets of hissing steam bursting from its sides marked the sites of subterranean fires. The high hills on each side of the gorge rose up in quaint fantastic shape, and their rugged sides composed of shattered volcanic rock sent forth water and jets of steam from a thousand fissures. Here boiling geysers emitting clouds of steam lashed their hot waves about and foamed with a furious sound in rock-bound basins, while scattered over the greater portion of this fiery wilderness were innumerable fumaroles all hard at work shooting out steam and vomiting black streams of liquid mud. Some of these were round, some flat, and others cup-shaped, while not a few assumed the form of miniature volcanoes.

It was opposite to this spot on the further shore of the lake, that Te Otukapurangi, or the "Fountain of the Clouded Sky" of the Maoris, or the Pink Terrace, rose from the water of the lake to an altitude of nearly 100 feet. Here the deposits of silica assumed the same general formation, and each terrace of steps was gracefully and marvellously shaped with rounded edges which swept about in waving curves. The various buttress-like masses which supported the fringed edges of the terraces bent over and formed miniature grottoes resplendent with festoons of pink-tinted silica and rose-coloured stalactites which appeared to have been woven together by nature into an intricate network and then crystallised into their present shape. Here the successive deposits or layers of silica-rock did not assume, like those of Te Tarata, a wonderful combination of delicate lacework around the edges of the terraces, but the siliceous laminations appeared even thinner, and reminded one of the corrugated surface of pink satin rep. It was, however, the variegated tints of this wondrous structure which rendered it even more remarkable than the gracefully symmetrical proportions of its incomparable design. As the blue-tinted water came rippling and falling from terrace to terrace in miniature cascades, Te Otukapurangi looked radiant in its sparkling mantle of delicate pink, and as the golden rays of the sun shot far and wide, it changed with every shade of light, with brilliant hues of pink, amber, carmine, and yellow, which shone with a dazzling and metallic lustre as they flashed and palpitated as it were in the warm glowing air.

At the summit of the terrace was a circular platform, in the centre of which was a steaming cauldron formed by an alabaster-like basin about 100 feet in diameter. Here the deep dark-blue water within a few degrees of boiling-point lay without a ripple upon its surface, and shone with the brilliancy of transparent

crystal, while beneath the siliceous deposits, which encrusted the sides of the crater, assumed all the varied designs of a coral grove tinted in glowing colours of yellow, blue, and pink.

From Lake Rotomahana the recent volcanic eruption extended to the Pairoa Mountains, which attain to an altitude of 1000 feet, and which, when visited by Mr. Kerry-Nicholls, were hot, and quaking with internal fires, boiling mud pools, and coiling jets of steam that burst with a hissing sound from the deeply-scarred hills. The base of this range, where the volcanic action was greatest, was formed of a burnt fiery-looking earth, broken here and there into enormous fissures, and dotted about with boiling pools and deep holes of hot seething mud, while clouds of vapoury steam burst forth from the highest peaks.

Following up the line of thermal activity across the island, as yet not known to be affected by the recent outbreak, hot springs and geysers are found at Orakeikorako on the banks of the Waikato and in various places along the whole valley of the rivers, and notably at Wairakei, where the thermal activity is both widespread and extraordinary in its variety. At Taupo, the great central lake of the island, geysers and other phenomena of the kind exist on its northern shores. From this point further across the lake the hot springs and geysers of Tokanu occur, while a short distance beyond rises the cone-shaped form of Tongariro, at an altitude of 7000 feet, the two craters which are in a state of very active *solfatara* constantly emit vast volumes of steam. Five miles to the south of the latter mountain rises the colossal form of Mount Ruapehu, which, with a base of over sixty miles, rises to an altitude of 6000 feet to the region of perpetual snow. This mountain, which was at one time the chief centre of volcanic activity of the north island, has been extinct from time immemorial, but it is reported that during the recent eruption steam was seen to issue from the crater. It is the highest point of the north island, and was ascended by Mr. Kerry-Nicholls and his interpreter, Mr. Turner, in 1883.

SCIENCE IN NEW SOUTH WALES

IN his Annual Address (on May 5) to the Royal Society of New South Wales, the President, Prof. Liversidge, referred to the death of Prof. Smith, the former President of the Society, and to the eminent services which he had rendered to the cause of science and of education in New South Wales, and also to other members of the Society who died during the past year. The President then expressed regret that the number of original papers contributed to the Society is so small. "It is not," he said, "from lack of subjects, for there are many questions which require investigation, but rather from the lack of competent investigators who can spare the necessary time. Up to the present but little original work has been done in working out the chemistry of the mineral and vegetable products, and but very little in many branches of biology. The descriptions, catalogues, lists, &c., of the flora and fauna, are making fair progress, but still very little has been published relating to the development and life-history of the fauna of Australia, even of forms of life peculiar to that part of the world. In matters of natural history, geology, and allied subjects it is apparent to every one that the materials for original work are in New South Wales abundant, and a considerable amount of very valuable work is being done in this direction by the Linnean Society of New South Wales, but the amount waiting to be done is far more than they can cope with at present. The Society, by offering a medal and a money prize, has done what it can to stimulate research; but the amount at its disposal is small. So many subjects if thoroughly worked out would be of economic value to the colony—such as the chemistry of Australian gums and resins, the tin deposits, iron ores, and silver ores of New South Wales—that the Government might with propriety assist the Society in undertaking these researches. Wealthy colonists might also, with advantage to the State and credit to themselves, encourage such original investigation." Speaking of biological work, the President said that one of the few facilities for scientific work possessed in Sydney, and which the Society assisted in founding, viz. the biological laboratory at Watson's Bay, has been closed, the Government having taken the house and grounds for defence purposes. The trustees will doubtless receive the cost of the buildings, and with this as a nucleus a fresh start can be made. It would be a great pity to allow such an undertaking to drop, especially as there is such an unlimited field for marine biological work in Australia. In regard to scientific education.

in the colony, Prof. Liversidge said that notwithstanding the liberality of Parliament and the receipt of private endowments for improved instruction in science, many of the arrangements for this purpose of the Sydney University are of a very meagre and imperfect character. The Board of Technical Education is now doing good work in spreading elementary, scientific, and technical education over the colony by means of science classes and itinerant lecturers. The necessity of scientific education is also being recognised; there is a motion before the Legislative Assembly to place the sum of 10,000*l.* upon the estimates for the establishment of schools of mines in the various mining centres, while another motion to be brought proposes to make provision for the creation and endowment of twenty scholarships of the value of 200*l.* per annum, each tenable for three years, at the Sydney University. The President then referred to Prof. Huxley's remarks in his anniversary address to the Royal Society on scientific federation. Prof. Huxley said:—"I have often ventured to dream that the Royal Society might associate itself in some special way with all English-speaking men of science; that it might recognise their work in other ways than by the rare opportunities at present offered by election to our foreign fellowship, while they must needs be deprived of part of its privileges." On this Prof. Liversidge remarks that though every one will agree as to the desirability of having closer bonds of union between the Royal Society and the men of science who are scattered over the wide areas of English-speaking countries, it does not appear easy to suggest a method of bringing it about. Good work in the Colonies, at any rate at present, is rarely overlooked by the Council of the Royal Society. Prof. Liversidge concluded his interesting address by suggesting a federation or union of the members of the various scientific societies in Australia, Tasmania, and New Zealand into an Australasian Association for the Advancement of Science, on the lines of the British Association, with a view to holding the first general meeting in Sydney on the hundredth anniversary of the founding of the colony. A meeting of the kind during the centennial year would offer a unique opportunity for the exchange of ideas and information, and it would not only have an immediate and beneficial effect, but would permanently raise the high-water mark of thought in all the colonies, especially in connection with scientific matters. It would be an opportunity to correlate and correct all the scattered and fragmentary geological maps and memoirs relating to the various colonies, and to adopt a uniform system of nomenclature, colouring, &c., for all Australasian geological maps. It would, pursued the President, be beneficial if botanists were to prepare and revise the census of plants for each colony, especially to show their distribution, and similar questions could be discussed by zoologists for land and marine organisms.

ICE MOVEMENTS IN HUDSON'S BAY¹

IN my report last year I described the ice as consisting of three kinds, viz., icebergs, heavy arctic ice and ordinary field ice. The icebergs are stated to have come from Fox Channel. This conclusion was based on the report from No. 3 station made on the homeward voyage of the *Neptune*, that the icebergs passed the bluff from west towards east. This report was made on the strength of the few observations which the party had been able to make in the interval between the two calls of the *Neptune* at the inlet. Further and more perfect observations show conclusively that the current sets in the opposite direction and that the icebergs move from east to west. If further proof of the existence of this set were necessary, we have it in the drift of the *Alert* when fast in the ice off Ashe Inlet and invariably carried to the westward.

In considering the question of the sources from which the ice affecting Hudson's Straits navigation comes, we must first begin with the east Greenland ice. All those who have made the voyage from any port in Europe to Hudson's Straits seem to agree in the statement that Cape Farewell must not be approached nearer than seventy miles in order to keep clear of the east Greenland ice which sweeps round the cape in an almost ceaseless stream, after rounding which it turns to the northward, and passes up the south-west shore of Greenland, nearly as high as Gothaab, then turns over to the west side of Davis' Straits, and joining the stream of Davis' Straits ice runs south with the arctic

current. The limits of the east Greenland ice field, when rounding Cape Farewell, vary greatly; in some years, it moves as far south as the parallel of 58° N. This ice field can be, and is of course always avoided, the rule in making the passage being to keep to the south of 58° N. till in longitude 58° W., on which meridian the northing should be made.

The stream of Davis' Straits ice flows right across the entrance to Hudson's Straits, and varies in width with the season of the year. The first information which I have of it was derived from conversation with Captain Watson, of the whaling barque *Maude* of Dundee, owned by Captain Adams. Captain Watson had been for many years engaged in the Davis' Straits whale fishing, and for the last few years has commanded his present vessel. Their usual routine is to leave Dundee in March, and they arrive off the edge of Davis' Straits ice in the early part of April, cruising off the edge of the ice between latitudes 58° N. and 63° N. Captain Watson told me, that he made the ice in April of this year about 58° N. and 120 miles off the Labrador coast, and up to the date of our meeting with him, June 13, he had not been able to get nearer to Resolution Island than thirty-five miles, and as the average southerly set of the current is about twenty miles per day, this stream of ice must have been flowing uninterruptedly up to June 15, the date on which the *Alert* took the pack. An examination of the records of the stations at Port Burwell and Nachvak Bay shows that at Port Burwell the ice cleared out of the Straits on April 9. They remained clear up to the 14th, when the ice came in sight again, and was present almost constantly thereafter until its final disappearance in August. At Nachvak the ice swung on and off the shore with the winds and tide, but though sometimes out of sight from the ordinary observation point, it was always seen upon going to a higher elevation. It is therefore certain that during the months of May, June, and July, large fields of ice were present in the entrance of the Straits, and the question remains, at what date was this ice in such a condition as to permit the passage of vessels strengthened for meeting the ice, but which could be used as freight steamers. For in all questions as to feasibility of the navigation I am not considering the date at which one of the Dundee whaling or Newfoundland sealing steamers could be forced through, but when a strongly built iron steamer, sheathed and otherwise strengthened, could make the passage.

On June 15, when we went into the ice, it was certainly impenetrable by any vessel of the class referred to, and though the ice would slacken at the turn of every tide, and sometimes run abroad so that it would have been possible to work the ship to the westward, distances varying from two to five miles at each of these slack times, I only tried to hold my own, generally under canvas; as apart from any question of the injury which the ship had received, I deemed it more desirable to watch the ice at the entrance of the Straits than to force the ship through, when I could only have made at the most ten to twenty miles a day. I am of opinion that the Straits were passable at the eastern entrance about the date that we returned to St. John's for repairs, viz., July 5, but any ship going in at this date would still have been subject to these delays, but might have made from twenty-five to forty miles a day.

Proceeding westward, from this date, July 5, the observations at Ashe Inlet and Stupart's Bay show that on the north side of the Straits, and from eighteen to twenty miles out, the ice was present almost continuously, much as we found it in August; some of the sheets of enormous extent and of great thickness. Many of these were, in August, over half a mile long, and some which we measured were from twenty to thirty feet in thickness. In the middle of July, Mr. Ashe reports that open water is visible beyond the ice, and Mr. Stupart, fog-banks and water sky frequently to the north. The two stations at the western end of the Straits also report that in the middle of July the ice was loose and drifting with the tide. Everything goes to show that though there would have been very frequent delays still it would have been possible for a steamship to have got through the Straits by July 15 or 20.

Ice would have been met with again, doubtless, in the bay, but I do not think there would have been any serious delay in reaching either Churchill or York Factory.

Stations on shore for the purpose of watching the movements of the ice, though undoubtedly the best system which we can adopt, cannot tell us with any degree of certainty how soon a vessel might be able to push her way through the Straits, but they do tell when it is sufficiently run abroad, or

¹ From the Report of the second Hudson's Bay Expedition under the command of Lieut. A. R. Gordon, R.N., 1885.